Synchrotron FT-IR Analysis of Collagen Localization in Normal, Cardiomyopathic and Losartan-treated Hamsters

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We are using infrared (IR) microspectroscopy in the study of dilated cardiomyopathy (DCM). Heart disease is often accompanied by the formation of scar tissue, which is actually the build up of various forms of collagen. The collagen is normally identified by microscopic examination of stained tissue (Figure. 1). Alternatively, the collagen may be extracted from the homogenate of the entire heart to yield a total collagen content. However, both the disease and drug treatments can induce changes in molecular composition, cellular structure and organization, best examined in situ, on the cellular scale (i.e.: micron scale).

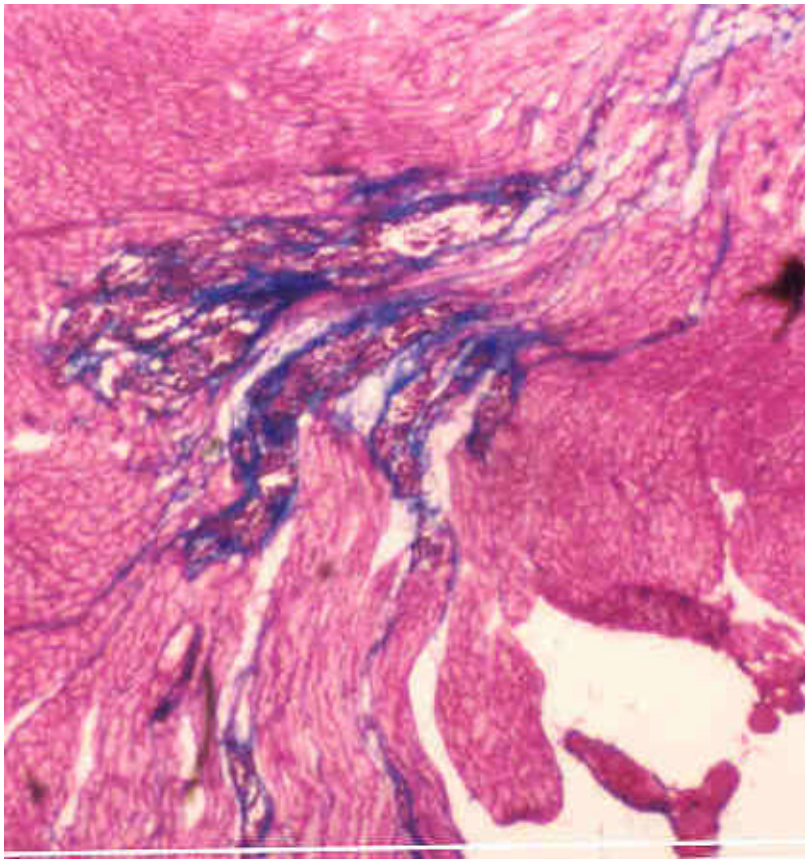

Figure 1. Photomicrograph of stained cardiomyopathic heart tissue from Syrian hamsters. Blue regions indicate high collagen concentration. Area shown is approximately 2 mm across.

With the bright synchrotron source, it is possible to obtain good quality vibrational spectra, and hence detailed information about molecular structure and composition, from a 5-micron × 5-micron pixel area (Figure. 2). With IR microspectroscopy of thin tissue slices from the heart, we can obtain a detailed map of the deposition and localization of collagen in model animals: the UM-X7.1 strain of Syrian hamsters. In cases where a collagen-reducing drug (losartan) was administered to the animals, we can assess the amount and type of collagen reduction achieved.

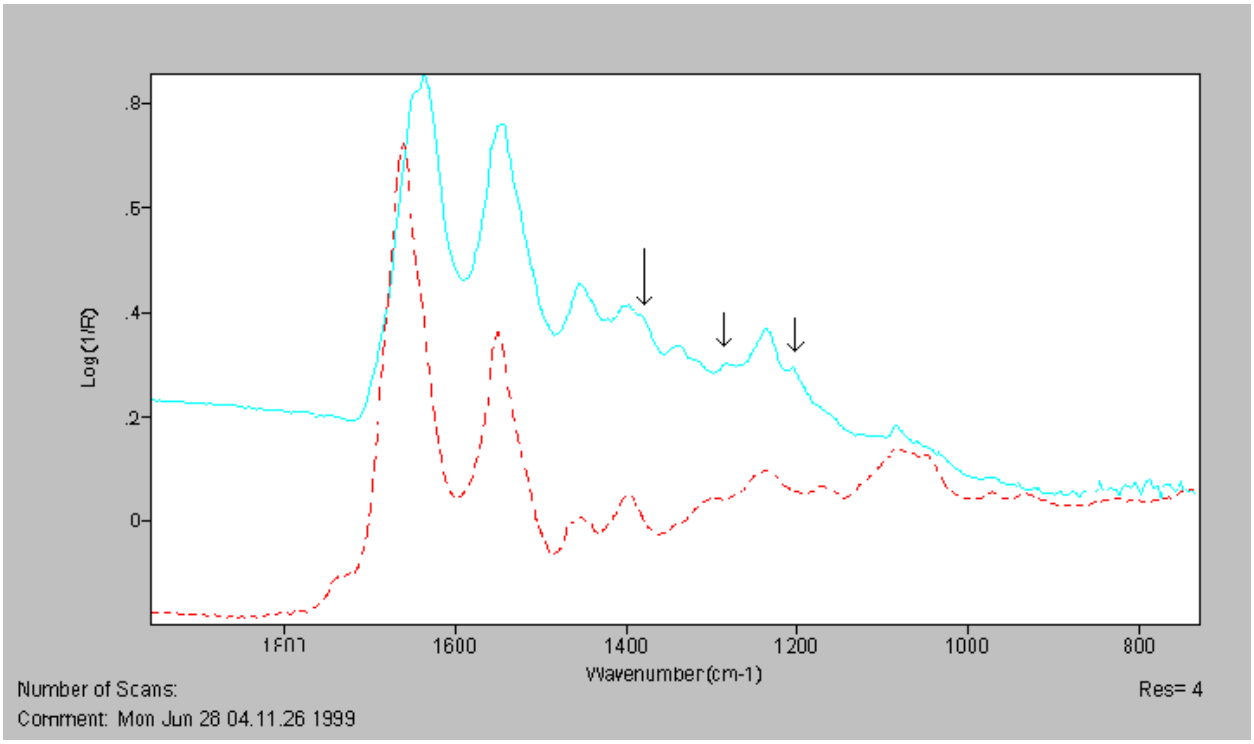

Figure 2. FT-IR spectrum of control (dashed red line) and cardiomyopathic (solid blue line) heart tissue. Characteristic collagen absorptions appear at 1204, 1284 and 1338 cm^{-1}.

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